



Summary of 2nd VCS Verification Project
Consent Decree 1:17-CV-01522-MSK-MJW

February 28, 2020

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DEFINITIONS

The definitions below are taken directly from PDC’s Consent Decree.

“Actual Uncontrolled Annual VOC Emissions” shall mean the amount of VOC emissions from a Tank System during the previous 12-month period based on actual production prior to the routing of those VOCs to an emission control device.

“CDPHE” shall mean the Colorado Department of Public Health and Environment, and its’ Air Pollution Control Division (“APCD”).

“Compromised Equipment” shall mean equipment associated with a Vapor Control System that is beginning to show signs of wear beyond normal wear and tear (and cannot be addressed by cleaning the equipment). Examples include, but are not limited to, cracks or grooves in gaskets, abnormally or heavily corroded equipment, beveling or other indications of inefficient connection of the thief hatch to the tank.

“Consent Decree” or “Decree” or “CD” shall mean this Consent Decree and all appendices attached hereto listed in Section XXV (Appendices).

“Engineering Design Standard” shall mean an engineering standard developed by PDC pursuant to Paragraph 9 of the CD (Engineering Design Standards).

“EPA” shall mean the United States Environmental Protection Agency and any of its successor departments or agencies.

“Flame Arrestor” shall mean a device in a Vapor Control System which allows gas to pass through it but stops a flame in order to prevent a larger fire or explosion.

“IR Camera Inspection” shall mean an inspection of a Vapor Control System using an optical gas imaging infrared camera designed for and capable of detecting hydrocarbon and VOC emissions, conducted by trained personnel who maintain proficiency through regular use of the optical gas imaging infrared camera.

“Modeling Guideline” shall mean the modeling guideline developed by PDC pursuant to Paragraph 8 of the CD (Development of a Modeling Guideline).

“Normal Operations” shall mean all periods of operation, excluding Malfunctions. For storage tanks at well production facilities, normal operations includes, but is not limited to, liquid dumps from the Separator.

“Potential Peak Instantaneous Vapor Flow Rate” or “PPIVFR” shall mean the maximum instantaneous rate of vapors routed to a Vapor Control System during Normal Operations, including flashing, working, and standing losses, as determined using the Modeling Guideline.

“Separator” shall mean a pressurized vessel used for separating a well stream into gaseous and liquid components.

“Tank System” shall mean one or more atmospheric tanks that store condensate, and any other interconnected tank (*e.g.*, produced water tank), that share a common Vapor Control System. The Tank Systems that are subject to this Consent Decree are identified in column one of Appendices A-1 and A-2.

“TPY” shall mean tons per year.

“Vapor Control System” or “VCS” shall mean the system used to contain, convey, and control vapors from one or more condensate tank(s) (including flashing, working, and standing losses, as well as any emissions routed to the condensate tank Vapor Control System). A Vapor Control System includes a Tank System, piping to convey vapors from a Tank System to a combustion device and/or vapor recovery unit, fittings, connectors, liquid knockout vessels, openings on tanks (such as PRVs and thief hatches), and emission control devices.

“VOC” or “VOCs” shall mean volatile organic compounds.

PROJECT OVERVIEW

Pursuant to Paragraph 18 of the Consent Decree (“CD”) between the United States Environmental Protection Agency (“EPA”), the State of Colorado Department of Public Health and Environment (“CDPHE”), and PDC Energy, Inc., Civil Action No. 1:17-cv-01552-MSK-MJW, PDC is required to verify that the Engineering Evaluations and any necessary modifications for the Tank Systems at issue were completed in accordance with the requirements of the CD for applicable Tank Systems. This report is intended to describe the work performed and conclusions reached as a result of this Vapor Control System (“VCS”) Verification project.

The VCS Verification Work Plan (“Work Plan”), required that PDC conduct a verification of a representative selection of 50% of applicable Tank Systems in 2018 and 50% of applicable Tank Systems in 2019. The Work Plan was initially submitted by PDC on January 31, 2019 and approved by the EPA, in consultation with the CDPHE, on February 27, 2019; upon the request of the EPA, it was then amended on August 29, 2019. This report is a summary of the verification of the 50% of applicable Tank Systems in Groups B, C, D and E. The report summarizing the verification of 50% of applicable Group A Tank Systems was submitted to EPA and CDPHE on August 29, 2019.

PROJECT OBJECTIVES

PDC completed the following objectives to ensure that the requirements of the 2nd VCS Verification project were met per Paragraph 18 of the CD.

- Developed and submitted a VCS Verification Work Plan identifying project staff and selected Tank Systems
- Determined if PDC’s consultant performing the Engineering Evaluation applied PDC’s Modeling Guideline correctly to determine the Potential Peak Instantaneous Vapor Rate (“PPIVFR”) in accordance with the requirements of the CD
- Determined if PDC’s consultant performing the Engineering Evaluation (1) applied the correct inputs and assumptions in calculating VCS capacity; and (2) correctly performed the calculations to evaluate the existing capacity of the VCS by using an Engineering Design Standard in accordance with the requirements of the CD
- Verified that PDC’s consultant performed the Engineering Evaluation comparison of the calculated PPIVFR to the calculated existing VCS capacity to determine that the VCS is adequately designed and sized to handle the PPIVFR
- Verified (via document and field review) that PDC made all necessary VCS modifications identified through the Engineering Evaluation performed by PDC’s consultant

WORK PLAN APPROVAL

PDC submitted the Second VCS Verification Work Plan to the EPA and CDPHE on January 31, 2019 per Paragraph 18.a of the CD. It was approved by the EPA and CDPHE on February 27, 2019. The Second VCS Verification Work Plan included PDC’s selected Verification Engineer and credentials, a description of the proposed activities to be conducted to complete the verification, including Tank System selection criteria and justification, and the proposed completion timeline.

While conducting the work described by this plan for the First Verification Report, PDC questioned whether groups D and E should have been included. Upon reaching out to the EPA and CDPHE, PDC revised the Work Plan to include these groups and submitted an amended Work Plan that included Tank Systems in groups D and E with the August 29, 2019 Semi-Annual Report. The same plan, as submitted

on January 31, 2019, was implemented to include Groups D and E; there have been no changes to the method in which this Verification was conducted.

TANK SYSTEM SELECTION METHOD

Pursuant to Paragraph 18 of the CD, PDC shall “use its best efforts to ensure that Tank Systems selected for verification are representative of all Tank Systems potentially included in that verification.” PDC applied several criteria to the list of applicable Tank Systems to ensure adequate representation. These criteria are as follows:

Actual Uncontrolled VOC Emissions (tpy) – PDC selected Tank Systems based on actual uncontrolled VOC emissions as represented by AIMM inspection frequencies set forth in Paragraph 14.b of the CD. The AIMM frequencies (monthly, quarterly or semi-annual) are generally reflective of facility production. Variances in facility production will be represented by selecting Tank Systems from each of the three frequencies.

Well Type – PDC has both horizontal and vertical wells. Tank Systems were selected to ensure that both types of well orientations were included. By selecting Tank Systems with different well types, it ensures that variances in age, production and facility design will be represented.

Tank System Design – PDC generally has three facility design configurations that it uses to modify its Tank Systems as part of the VCS modification. Differences between the three configurations largely depends on how vapors and liquids are routed to the sales lines and/or storage tanks. By ensuring that the three configurations are included in the selected Tank Systems, variances in stages of separation and pressures upstream of the storage tanks will be represented.

Geography – Applicable Tank Systems are located throughout southwestern Weld County. PDC has defined the areas of applicable Tank Systems into three geographical regions. By ensuring that the three geographical regions are included in the selected Tank Systems, variances in line pressure, Gas/Oil ratio and oil composition will be represented.

A. Striated Approach for Tank System Selection

Using an Excel spreadsheet, each Tank System was allocated an attribute from each criteria. For example:

Tank System: Anderson 13-34
LDAR Frequency: Quarterly
Well Type: Vertical
Tank System Design: Configuration 1
Geography: North

Of the 310 Tank Systems in Tank System Group B, C, D and E, 159 were shut in by the engineering evaluation deadline and, therefore, were not included in the Certification of Completion Report submitted to the EPA and CDPHE after March 1, 2018. These Tank Systems were shut in due to the following: P&A Planned, Evaluation Delayed, P&A Complete, or Long Term Shut-in. Therefore, there were 151 Tank Systems included in the Certification of Completion Reports submitted to EPA and CDPHE after March 1, 2018. PDC included 50% of those applicable Tank Systems in this second verification process. **Appendix E** of this report includes 76 Tank Systems that PDC verified for design and **Appendix F** of this report includes 76 Tank Systems that PDC verified for documentation.

PDC used a striated selection approach to get a representative sample of Tank Systems that included all categories presented above. The following table demonstrates how PDC applied its criteria to the list of applicable Tank Systems.

	<i>Total of 151</i>	<i>Percentage of 151</i>	<i>Total Number Selected for Design Review (76 Tank Systems)</i>	<i>Percentage of 151</i>	<i>Total Number Selected for Documentation Review (76 Tank Systems)</i>
Criteria: AIMM Frequency					
Monthly	12	50%	6	58%	7
Quarterly	26	54%	14	58%	15
Semi-Annual	113	50%	56	48%	54
Criteria: Geography					
East	60	43%	26	45%	27
West	22	50%	11	59%	13
South	30	57%	17	60%	18
North	39	56%	22	46%	18
Criteria: Well Type					
Horizontal	50	60%	30	60%	30
Vertical	101	46%	46	46%	46
Criteria: Configuration					
Configuration 1	59	44%	26	46%	27
Configuration 2	17	59%	10	59%	10
Configuration 3	59	53%	31	51%	30
Configuration 1/2	11	55%	6	64%	7
Configuration 2/3	3	33%	1	33%	1
Configuration 1/3	1	100%	1	100%	1
Configuration 1/2/3	1	100%	1	0%	0

VCS VERIFICATION METHODS

There are two parts to this VCS Verification project summary—the Tank System Design Evaluation and the Tank System Data Evaluation. The Tank System Design Evaluation reviews the data inputs and assumptions that went into the VCS Engineering Evaluation and reviews the data outputs and recommendations that were provided as a result of the VCS Engineering Evaluation. The Tank System Data Evaluation reviews the field survey data, construction and production work orders, semi-annual reporting, and recordkeeping that was captured in the system of records to ensure that any necessary VCS modifications were completed.

A. Tank System Design Evaluation Methods

PDC's Verification Engineer conducted a document review of each Tank System to verify that the consultant properly applied the Modeling Guideline (version dated 9/29/2017) and properly applied the applicable Design Standard (ZSTD-0009, version dated November 2017) to ensure that the VCS are adequately designed and sized to handle the PPIVFR. In addition, the document review verified that the correct inputs and assumptions were applied when calculating the VCS Capacity, and that the calculations themselves were correct. The applicable Modeling Guideline and Engineering Design Standard are included as **Appendix B** and **Appendix C**, respectively. Please note that the Modeling Guideline and Engineering Design Standard constitute PDC Confidential Business Information and have been identified and labeled as such.

The documents reviewed by the Verification Engineer include, but are not limited to:

- Modeling Guideline
- Engineering Standards
- Certification of Completion Reports
- Documents related to Engineering Evaluation inputs and assumptions
- Consultant's Engineering Evaluation model spreadsheets
- Calculations including PPIVFR and VCS capacity

The CD required PDC to complete a review of the consultant's Engineering Evaluation. This internal review included the following requirements [*Consent Decree 18.b.(1) through thought (3)*]:

- "...verify that PDC's consultant performing the Engineering Evaluation applied the Modeling Guideline correctly to determine the Peak Potential Instantaneous Vapor Flow Rate..."
- "...verify that PDC's consultant performing the Engineering Evaluation applied the correct inputs and assumptions in calculating Vapor Control System capacity..."
- "...correctly performed the calculations to evaluate the existing capacity of the Vapor Control System by using an Engineering Design standard in accordance with the requirements of this Decree;"
- "...verify that PDC's consultant performed the Engineering Evaluation comparison of the calculated Peak Potential Instantaneous Vapor Flow Rate to the calculated existing Vapor Control System capacity to determine that the Vapor Control System is adequately designed and sized to handle the Peak Instantaneous Vapor Flow Rate."

The VCS capacity was calculated at steady state, while the PPIVFR often occurs for a shorter duration than what would be required to reach steady state. Therefore, PDC determined that as long as the maximum calculated tank pressure does not exceed the pressure relief device (PRV) set point, the Tank System satisfied the requirement that "the Vapor Control System is adequately designed and sized to handle the Peak Instantaneous Vapor Flow Rate" per Paragraph 10 of the CD. This is true even if PPIVFR exceeds the VCS capacity.

For Tank System Group A, PDC produced an internal calculation for each tank system to verify the consultant's calculation. By reproducing the 130 evaluations in Group A, PDC identified all systemic errors in the consultant's model, and vetted the consultant's calculation. As discussed in the report for Tank System Group A ("Summary of 1st VCS Verification Project"), all systemic errors in the consultant's model had been corrected by 6/30/17. PDC considers the calculations contained in any model revision from after this date to be correct and reliable. For this reason, PDC elected *not* to reproduce the consultant model for each VCS Analysis in Tank System Groups B-E. Having established the validity of the consultant model calculations, PDC conducted the Tank System Design Evaluation by verifying the following:

- Correct Inputs and Assumptions

- Up-to-date Model
- Up-to-date ECD Capacity

PDC considered the VCS Design to be verified if either, a.) the above conditions are met, and the model predicts a peak tank pressure less than the PRV setpoint or b.) the calculation was re-produced with correct inputs, up-to-date model version and up-to-date ECD capacities, and shown to have a peak tank pressure less than the PRV setpoint.

1. Correct Inputs and Assumptions

The input verification step satisfies the requirement to “...verify that PDC’s consultant performing the Engineering Evaluation applied the correct inputs and assumptions in calculating Vapor Control System capacity...” This step verified that the data collected by PDC and provided to the consultant matched the inputs entered into the consultant’s model. Discrepancies were noted. Upon completion of the calculation verification, explained below, discrepancies were only re-examined to the extent that they affected the calculation results.

Not all of the data included in PDC’s data collection was compared with the consultant’s input. For example, wellhead choke size is not an input to the calculation, so it was not verified. Choke position affects oil production rate, cycles per day, and separator inflow. Each of these are calculation inputs, so the effect of choke position is captured, even though they are not verified inputs.

PDC’s Verification Engineer selected the model inputs that were verifiable and had potential to significantly affect calculation results. The table below summarizes the inputs verified for each site, and calculation(s) that each input affects.

Parameter	Relevant Calculation(s)
Operating mode (plunger, flowing, etc)	Slug size, PPILFR (Peak Potential Instantaneous Liquid Flor Rate), PPIVFR
Tank count, size, & % full	Peak tank pressure (dynamic analysis)
Initial tank pressure	Peak tank pressure (dynamic analysis)
Vapor header size, length, & fittings	VCS capacity
ECD type, quantity, & accessories (flame arrestor, shutoff valve)	VCS capacity
Average daily oil production	Slug size, PPILFR, PPIVFR
Average cycles per day	Slug size, PPILFR, PPIVFR
Separator pressure	PPILFR, PPIVFR
Valve trim / restriction orifice size	PPILFR, PPIVFR

In addition to inputs from PDC data collection, this step also verified calculation assumptions that apply to all models. Such assumptions include separator temperature and critical pressure. The Modeling Guideline includes a full discussion of relevant assumptions.

2. Up-to-date Model

Group A VCS Verifications established that the systemic errors present in the consultant model were corrected by the end of Q2 2017. Therefore, verifying the version date of the model (6/30/17 or later) is sufficient to verify the accuracy of the calculation. Any consultant calculation performed on a version from before 6/30/17 was re-created using the latest template to ensure calculation accuracy.

3. Up-to-date ECD Capacity

As reported in the August 29, 2019 Semi-annual Report, in the first half of 2019, PDC discovered that vendor-published ECD capacities had been revised downward for some ECD types. If one or more of the affected ECD types was part of any VCS Verification, the calculation was re-produced with the updated capacity to verify satisfaction of the Design Standard. If the resulting peak tank pressure was less than the PRV setpoint, the Design Evaluation was considered verified. Conversely, if the resulting peak tank pressure exceeded the PRV setpoint, the Design Evaluation was flagged for re-examination.

b. TANK SYSTEM DATA EVALUATION METHOD

An EHS Representative conducted a review of the collection of attributes for each Tank System to ensure that any necessary VCS modifications were completed, and that that reports matched the systems of record for that data.

1. Tank System Data Evaluation Sheet

The EHS Representative built a Data Evaluation sheet to aid in the document review for each Tank System. This Data Evaluation Sheet allowed for a consolidated location to “verify that necessary modifications identified through the Engineering Evaluation performed by PDC’s consultant have been completed in accordance with the requirements of this Decree” [*Consent Decree 18.b.(4)*]. This included, for example, a review of the work orders opened in PDC’s Workorder Tracking System to ensure that they matched the modifications listed in the Engineering Evaluations and Certification of Completion Reports.

ANALYSIS OF RESULTS - TANK SYSTEM DESIGN REVIEW

PDC verified that 72 of the 76 Tank Systems Designs (95%) were “designed and sized to handle the PPIVFR.” Based on the Design Analyses, PDC could not verify the same for the remaining 4 of the 76 Tank System Designs. These results are included in **Appendix D**.

A. Out-of-date ECD capacity (Three Tank Systems)

PDC discovered instances where the ECD capacity used in the model was not consistent with the latest published capacity from the ECD vendor. These assumptions were not errors because they were based on vendor data available at the time, and these inputs changed between the original analyses and PDC’s verification. In all cases, PDC’s verification calculation used the most recent vendor-published capacities available.

As a result of the re-evaluation of these three Tank Systems, additional modifications were completed by August 22, 2019. Please note that the results of these re-evaluations were also reported as Post-Certification of completion evaluations in the August 29, 2019 semi-annual report.

B. Input discrepancies (One Tank System)

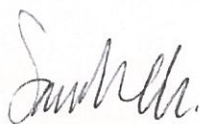
PDC discovered one discrepancy between consultant model inputs and data collection / current equipment inventories. The consultant model included an ECD that is used only for tank isolation and does not affect the VCS capacity during normal production. This overestimated the VCS capacity. This Tank System was shut-in and locked out on November 7, 2019 and will be re-evaluated should it be returned to service.

ANALYSIS OF RESULTS - DATA RECORD REVIEW

Of the 76 Tank Systems whose data was evaluated as part of the 2nd Verification, 76 Tank Systems (100%) had adequate documentation to confirm that any necessary VCS modifications were completed. No further action was required of these Tank Systems. These results are included in **Appendix E**.

CERTIFICATION

Per Paragraph 18.d. I certify that the verification duties contained in Consent Decree Subparagraphs 18.b.(1) through (4) were completed in accordance with the requirements of this Decree.



Sarah Koziolkowsky
Senior Air Quality Representative – Wattenberg



Eric Schwartz
Senior Facilities Engineer

CONCLUSION

PDC completed the VCS Verification per the approved 2nd VCS Verification Work Plan on time for 76 Tank Systems in Groups B through E (76 reviewed for design and 76 reviewed for documentation). Of the reviewed Tank Systems, 95% were verified to have been evaluated correctly. 100% of the reviewed Tank Systems were verified to have adequate documentation to confirm that any necessary VCS modifications were completed.

Appendix A
Tank Systems Selected for 2nd Verification

Tank System ID	AIRS ID	Tank System Name	Well Type	LDAR Frequency	Geopgraphical Region	Configuration	Design Review	Documentation Review
321	123-5868	Adams 31, 41-10, 41-10H; Wolfrum 42-10	Vertical	Semi-Annual	East	3	X	X
556	123-1617	Alles 22 Sec Pad 1 & 2; 9-22	Horizontal	Monthly	North	3	X	X
326	123-6630	Anderson 21, 22-34	Vertical	Semi-Annual	North	1		X
610	123-8441	Apollo 41, 42-18	Vertical	Semi-Annual	North	2	X	X
330	123-9E68	Becker Ranch 5 (Pad 1) E-223,403;J-303,343	Horizontal	Semi-Annual	South	3	X	X
332	123-9E5A	Becker Ranch 5 (Pad 3) M-203,323,423; R-243,303,443	Horizontal	Quarterly	South	3	X	X
333	123-9E5A	Becker Ranch 5 (Pad 4) R-203, 323; U-243, 303, 443	Horizontal	Quarterly	South	3	X	X
444	123-1657	Bihain 26-1, 4; 5	Vertical	Quarterly	East	1	X	X
449	123-5022	Booth 14, 23, 24, 33-35	Vertical	Semi-Annual	East	1	X	X
611	123-9C05	Booth G, H, I, J, K-26H;Booth 4, 7, 21, 24, 25, 27, 28, 31-26; 19-23	Vertical	Quarterly	North	1/2/3	X	
613	123-9954	Bosworth-Bailey 9, 20, 16-31	Vertical	Semi-Annual	North	3	X	
559	123-1676	Brent 1-6I; 1; Duell 20-1; Lucille 1-6I, 20-1; Pigeon 1, 5; 1-6B	Vertical	Quarterly	North	1	X	X
561	123-9B37	Brown 2E-232; 2F-202, 412, 432; 2G-212	Horizontal	Semi-Annual	North	1/2	X	X
342	123-7924	Cannon Farms 1-35C	Vertical	Semi-Annual	South	1	X	X
451	123-5950	Caraccioli 1	Vertical	Semi-Annual	East	2	X	X
562	123-1492	Carlson 33, 34-7	Vertical	Semi-Annual	North	1	X	X
564	123-9AD4	Carmichael 26M-223, 26R-203, 26U-243	Horizontal	Semi-Annual	North	1/2	X	X
454	123-5873	Cecil 31, 41-2	Vertical	Semi-Annual	East	1	X	X
456	123-9E04	Chesnut 28 (Pad 2) M-203,323,423; 28R-243,443	Horizontal	Quarterly	East	3	X	X
346	123-9E11	Churchill 28 Sec. 28E-203, 423; 28J-203, 343, 423, 443; 28M-343, 44	Horizontal	Monthly	East	3		X
347	123-5030	Cockroft 33, 34, 43, 44-11	Vertical	Semi-Annual	East	1	X	X
463	123-9C8D	Diana 6T-241, 321, 401; 6Q-421	Horizontal	Semi-Annual	East	3	X	X
616	123-9C68	Dyer 1, 2-2	Vertical	Semi-Annual	North	3	X	
465	123-2407	Eckhart 34-1; 34, 43, 44-34; 5	Vertical	Quarterly	East	1	X	X
570	123-1629	Emily 1; 24-19; Mowery 19-1; 5; Ivan Klein 13-20	Vertical	Quarterly	North	1	X	X
353	123-5220	Ewing 1; 32-31	Vertical	Semi-Annual	South	1	X	X
467	123-5871	Fabrizius 31, 41-1; Bay Family Trust 32-1	Vertical	Semi-Annual	East	2/3	X	X
354	123-6790	Floyd 5;Tarin Federal 32 Sec HZ (32W-234,434;32X-204,314,334;32Y-214,314,404)	Vertical	Monthly	South	3	X	X
618	123-9899	Gies 11, 14, 19-32	Vertical	Semi-Annual	North	2	X	X

Tank System ID	AIRS ID	Tank System Name	Well Type	LDAR Frequency	Geopgraphical Region	Configuration	Design Review	Documentation Review
478	123-9DAB	Guttersen 31Q-221, 401; 31T-301, 441 (Pad 2)	Horizontal	Semi-Annual	South	3	X	X
479	123-9DA2	Guttersen 31T-221, 401; 31Y-301, 441 (Pad 4)	Horizontal	Semi-Annual	South	2	X	X
483	123-9DA7	Guttersen 6R-323; 6U-203 (Pad 3)	Horizontal	Semi-Annual	South	3	X	X
360	123-7022	Hankins 43, 44-20U	Vertical	Semi-Annual	West	1/2		X
488	123-9D88	Hill 6L-421	Horizontal	Semi-Annual	West	2	X	X
623	123-9A7F	Holton 24-12	Vertical	Semi-Annual	North	2	X	
622	123-9D81	Holton I, J, K, L-12HN, HC	Horizontal	Semi-Annual	North	3	X	
370	123-4506	Johnson 2-21	Vertical	Semi-Annual	West	1	X	X
581	123-9F2B	Josephine 19 Sec HZ, Seth 1 & 5	Horizontal	Monthly	North	2	X	X
624	123-9E4A	Kaiser A, B, C, D, E F, G, H-10HN, HC / Kaiser 17, 41, 42-10	Vertical	Quarterly	North	3		X
493	123-9399	Kniesel 13, 14, 23, 24-12D; 12BD	Vertical	Semi-Annual	West	3	X	X
373	123-4521	Knox 41-3	Vertical	Semi-Annual	West	1	X	X
375	123-5160	Lapp 33-12, Schrant 23, 24-12	Vertical	Semi-Annual	East	1	X	X
377	123-2470	Lee 1-10	Vertical	Semi-Annual	South	1/2	X	X
378	123-9235	Leffler 33, 34-2; 2SD	Vertical	Semi-Annual	West	2	X	X
498	123-2478	Loloff 35-5	Vertical	Semi-Annual	East	1	X	X
499	123-9F06	Loloff Farms 26 Sec Pad 1	Horizontal	Monthly	East	3	X	X
583	123-4218	Maxey-Hoff 1, 2	Vertical	Semi-Annual	North	1	X	X
506	123-6115	McLeod 1, 5; 1-29B	Vertical	Semi-Annual	South	1	X	X
631	123-9953	NC Farms 9, 10, 15, 16, 20-32	Vertical	Semi-Annual	North	3	X	X
632	123-8447	Noco Energie 3, 4, 6, 12, 25-3	Vertical	Semi-Annual	North	3	X	
511	123-5946	Noffsinger 31,32-2D; 2C,RD,SD,VD; Frudden 1	Vertical	Semi-Annual	East	3	X	X
512	123-9CB1	O Investment Properties 6T-421; Y-241, 401	Horizontal	Semi-Annual	East	3	X	X
392	123-4233	Opel 17-2; 3, 4, 5	Vertical	Semi-Annual	South	1	X	X
515	123-6987	P&H 22-32, 42; 22CD, 22SD	Vertical	Quarterly	East	1	X	X
394	123-4248	Peschel 20 Sec HZ; 5-20	Horizontal	Quarterly	South	1/3	X	X
395	123-6093	Peschel 23-20B	Vertical	Semi-Annual	South	1	X	X
519	123-5960	Pettinger 33, 34, 43, 44-2	Vertical	Semi-Annual	East	1	X	X
400	123-9CF8	Richter 34M-203, 423; 34R-343	Horizontal	Semi-Annual	East	3	X	X
401	123-9CF8	Richter 34R-223, 403, 423; 34U-303	Horizontal	Semi-Annual	East	3	X	X
592	123-9ACA	Schaefer 10E-223, 10J-203, 403, 10M-243	Horizontal	Semi-Annual	North	1/2	X	X
590	123-4230	Schneider 19 Sec HZ	Vertical	Monthly	North	1		X
591	123-4230	Phil Wilson 19-1	Vertical	Monthly	North	1	X	
407	123-3043	Shupe 13-32, 33; Moore 13-31, 35	Vertical	Semi-Annual	West	1/2	X	X
525	123-9B92	Simonsen 12E-223; 12J-243; 1I-421; 1L-241	Horizontal	Semi-Annual	West	3	X	X

Tank System ID	AIRS ID	Tank System Name	Well Type	LDAR Frequency	Geopgraphical Region	Configuration	Design Review	Documentation Review
527	123-9C3C	Simonsen-Schaefer 7E-203, 423; 7J-243, 403; 7M-243	Horizontal	Semi-Annual	West	3	X	X
410	123-9EEA	Spaur 10 Sec Pad 1	Horizontal	Monthly	South	3	X	X
597	123-4541	State Lease 81 23-16	Vertical	Semi-Annual	North	1	X	X
531	123-9713	Stille 12-6H	Horizontal	Semi-Annual	East	3	X	X
417	123-9E41	Stroh 13 Sec Pad 1/2	Horizontal	Quarterly	South	3	X	X
532	123-9E01	Suden 34M-223, 423; 34R-203, 343 (West Pad)	Horizontal	Semi-Annual	East	3	X	X
504	123-2578	SunMarke 28V-234, 304, 434; 28W-414;McCarty 28-2(South)	Vertical	Quarterly	South	3	X	X
505	123-2578	SunMarke 28U-334, 434; 28V-214, 404 (North)	Vertical	Quarterly	South	3		X
599	123-9DC8	Thornton 14K-441	Horizontal	Semi-Annual	North	3	X	X
419	123-9DED	Thornton 15E-432	Horizontal	Semi-Annual	West	2	X	X
422	123-8292	Trinity 23-7; Johnston 14-7	Vertical	Quarterly	East	1	X	X
537	123-4496	Webster 32, 41, 42-11	Vertical	Semi-Annual	East	1	X	X
550	123-9521	Wells Ranch 43-34H	Horizontal	Semi-Annual	East	3	X	X
429	123-7460	Wiedeman 11, 12, 21, 22-21 U	Vertical	Semi-Annual	West	2		X
431	123-7224	Wiedeman 33, 43-21 U	Vertical	Semi-Annual	West	2	X	X
551	123-6203	Wilson 11, 12, 21, 22-30	Vertical	Semi-Annual	East	1	X	X
608	123-9326	Wilson 34-34H	Horizontal	Semi-Annual	North	1/2	X	X
434	123-1488	Witwer 34, 44-6D, 43-6; Hoff 33-6	Vertical	Semi-Annual	East	1	X	X
437	123-7011	Zimmerman 11D, 12, 21D, 22-17 U, 17AD U	Vertical	Quarterly	West	3	X	X

Appendix B

Modeling Guidelines



MODELING GUIDELINE

ZAP Engineering and Construction Services, Inc. for
PDC Energy, Inc.

PDC ENERGY, INC.
DJ BASIN CONSENT DECREE

CONFIDENTIAL BUSINESS INFORMATION

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Attachment C
Engineering Design Standard

Oil Production Facility Storage Tank Vapor Control System Design, Guide to

ZSTD-0009

THIRD EDITION, SEPTEMBER 2018

CONFIDENTIAL BUSINESS INFORMATION



ZAP ENGINEERING AND CONSTRUCTION SERVICES
333 SOUTH ALLISON PARKWAY, LAKEWOOD CO 80223

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CONFIDENTIAL BUSINESS INFORMATION



ZAP ENGINEERING AND CONSTRUCTION SERVICES
333 SOUTH ALLISON PARKWAY, LAKEWOOD CO 80223

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Attachment D
Results Summary for Tank System Design Review

Tank System ID	Tank System AIRS ID	Tank System Name	Verification Result	Tank System Design Review Discrepancy Results	Corrective Action	Corrective Action Complete Date
321	123-5868	Adams 31, 41-10; 41-10H; Wolfrum 42-10	Confirmed	N/A	N/A	N/A
330	123-9E68	Becker Ranch 5 (Pad 1) E-223, 403; J-303, 343	Confirmed	N/A	N/A	N/A
332	123-9E5A	Becker Ranch 5 (Pad 3 & 4) M-203,323,423; R-243,303,443; R-203,323;U-243,303,443	Confirmed	N/A	N/A	N/A
333	123-9E5A	Becker Ranch 5 (Pad 3 & 4) M-203,323,423; R-243,303,443; R-203,323;U-243,303,443	Confirmed	N/A	N/A	N/A
342	123-7924	Cannon Farms 1-35C	Re-examine	Out-of-date ECD capacity	Separator flow management	8/16/19
347	123-5030	Cockroft 34, 43, 44-11	Confirmed	N/A	N/A	N/A
353	123-5220	Ewing 1, 32-31	Confirmed	N/A	N/A	N/A
354	123-6790	Floyd 5;Tarin Federal 32 Sec HZ (32W-234,434;32X-204,314,334;32Y-214,314,404)	Confirmed	N/A	N/A	N/A
370	123-4506	Johnson 2-21	Confirmed	N/A	N/A	N/A
373	123-4521	Knox 41-3	Confirmed	N/A	N/A	N/A
375	123-5160	Lapp 33-12, Schrant 23, 24-12	Confirmed	N/A	N/A	N/A
377	123-2470	Lee 1-10	Confirmed	N/A	N/A	N/A
378	123-9235	Leffler 33, 34-2 & 2SD	Confirmed	N/A	N/A	N/A
392	123-4233	Opel 17-2; 3, 4, 5	Confirmed	N/A	N/A	N/A
394	123-4248	Peschel 20 Sec HZ; 5-20	Confirmed	N/A	N/A	N/A
395	123-6093	Peschel 23-20B	Confirmed	N/A	N/A	N/A
400	123-9CF8	Richter Pad - 34 Section (East)	Confirmed	N/A	N/A	N/A
401	123-9CF8	Richter Pad - 34 Section (West)	Confirmed	N/A	N/A	N/A
407	123-3043	Shupe 13-32/ Moore 13-31, 35	Re-examine	Out-of-date ECD capacity	Replacement of ECD(s); Separator flow management	8/22/19
410	123-9EEA	Spaur 10 Sec Pad 1&2	Confirmed	N/A	N/A	N/A
417	123-9E41	Stroh 13 Sec Pad 1/2	Confirmed	N/A	N/A	N/A
419	123-9DED	Thornton 15E-432	Confirmed	N/A	N/A	N/A
422	123-8292	Trinity 23-7; Johnston 14-7	Confirmed	N/A	N/A	N/A
431	123-7224	Wiedeman 33, 43-21 U	Confirmed	N/A	N/A	N/A
434	123-1488	Witwer 34, 44-6D, 43-6/ Hoff 33-6	Confirmed	N/A	N/A	N/A

Tank System ID	Tank System AIRS ID	Tank System Name	Verification Result	Tank System Design Review Discrepancy Results	Corrective Action	Corrective Action Complete Date
437	123-7011	Zimmerman 11D, 12, 22-17 U, 17AD U	Re-examine	Out-of-date ECD capacity	Separator flow management	8/22/19
444	123-1657	Bihain 26-1, 4; 5	Confirmed	N/A	N/A	N/A
449	123-5022	Booth 14, 23, 24, 33-35	Confirmed	N/A	N/A	N/A
451	123-5950	Caraccioli 1	Confirmed	N/A	N/A	N/A
454	123-5873	Cecil 31, 41-2	Confirmed	N/A	N/A	N/A
456	123-9E04	Chesnut 28 Pad	Confirmed	N/A	N/A	N/A
463	123-9C8D	Diana 6T-321, 241, 401; 6Q-421	Confirmed	N/A	N/A	N/A
465	123-2407	Eckhardt 34-1; 34, 43, 44-34; 5	Confirmed	N/A	N/A	N/A
467	123-5871	Fabrizius 31, 41-1/ Bay Family Trust 32-1	Confirmed	N/A	N/A	N/A
478	123-9DAB	Guttersen 31Q-221, 401; 31T-301, 441	Confirmed	N/A	N/A	N/A
479	123-9DA2	Guttersen 31T-221, 401; 31Y-301, 441	Confirmed	N/A	N/A	N/A
483	123-9DA7	Guttersen 6R-323, 6U-203 (Pad 3)	Confirmed	N/A	N/A	N/A
488	123-9D88	Hill 6L-421	Re-examine	Input discrepancies	Shut-in and lock out	11/7/19
493	123-9399	Kniesel 13, 14, 23, 24-12D & 12BD	Confirmed	N/A	N/A	N/A
498	123-2478	Loloff 35-5	Confirmed	N/A	N/A	N/A
499	123-9F06	Loloff Farms 26 Sec Pad 1	Confirmed	N/A	N/A	N/A
504	123-2578	McCarty 28-2; Sunmarke 28U-334, 434; 28V-214, 234, 304, 404, 434; 28W-414	Confirmed	N/A	N/A	N/A
506	123-6115	McLeod 1, 5; 1-29B	Confirmed	N/A	N/A	N/A
511	123-5946	Noffsinger 31,32-2D; 2C,RD,SD,VD/ Frudden 1	Confirmed	N/A	N/A	N/A
512	123-9CB1	O Investment Properties 6T-421, 6Y-241, 401	Confirmed	N/A	N/A	N/A
515	123-6987	P&H 22-32, 42; 22CD, 22SD	Confirmed	N/A	N/A	N/A
519	123-5960	Pettinger 33, 34, 43, 44-2	Confirmed	N/A	N/A	N/A
525	123-9B92	Simonsen 12E-223, 1I-421, 1L-241, 12J-243	Confirmed	N/A	N/A	N/A
527	123-9C3C	Simonsen Schaefer 7E-203, 423; 7J-243, 403; 7M-243	Confirmed	N/A	N/A	N/A

Tank System ID	Tank System AIRS ID	Tank System Name	Verification Result	Tank System Design Review Discrepancy Results	Corrective Action	Corrective Action Complete Date
531	123-9713	Stille 12-6H	Confirmed	N/A	N/A	N/A
532	123-9E01	Suden 34 Pad	Confirmed	N/A	N/A	N/A
537	123-4496	Webster 32, 41, 42-11	Confirmed	N/A	N/A	N/A
550	123-9521	Wells Ranch 43-34H	Confirmed	N/A	N/A	N/A
551	123-6203	Wilson 11, 12, 21, 22-30	Confirmed	N/A	N/A	N/A
556	123-1617	Alles 22 Sec Pad 1; 9-22	Confirmed	N/A	N/A	N/A
610	123-8441	Apollo 41, 42-18	Confirmed	N/A	N/A	N/A
611	123-9C05	Booth G, H, I, J, K-26H; Booth 4, 7, 21, 24, 25, 27, 28, 31-26; 19-23	Confirmed	N/A	N/A	N/A
613	123-9954	Bosworth-Bailey 9, 20, 16-31	Confirmed	N/A	N/A	N/A
559	123-1676	Brent 1-6I; 1; Duell 20-1; Lucille 1-6I, 20-1; Pigeon 1, 5; 1-6B	Confirmed	N/A	N/A	N/A
561	123-9B37	Brown 2E-232; 2F-202, 412, 432; 2G-212	Confirmed	N/A	N/A	N/A
562	123-1492	Carlson 33, 34-7	Confirmed	N/A	N/A	N/A
564	123-9AD4	Carmichael 26M-223, 26U-243	Confirmed	N/A	N/A	N/A
616	123-9C68	Dyer 1, 2-2	Confirmed	N/A	N/A	N/A
570	123-1629	Emily 1; 24-19; Mowery 19-1; 5; Ivan Klein 13-20	Confirmed	N/A	N/A	N/A
623	123-9A7F	Holton 24-12	Confirmed	N/A	N/A	N/A
622	123-9D81	Holton I, J, K, L-12HN, HC	Confirmed	N/A	N/A	N/A
583	123-4218	Maxey-Hoff 1, 2	Confirmed	N/A	N/A	N/A
632	123-8447	Noco Energie 3, 4, 6, 12, 25-3	Confirmed	N/A	N/A	N/A
591	123-4230	Phil Wilson 19-1	Confirmed	N/A	N/A	N/A
592	123-9ACA	Schaefer 10E-223, 10M-243	Confirmed	N/A	N/A	N/A
581	123-9F2B	Seth 1, 5	Confirmed	N/A	N/A	N/A
599	123-9DC8	Thornton 14K-441	Confirmed	N/A	N/A	N/A
608	123-9326	Wilson 34-34H	Confirmed	N/A	N/A	N/A
618	123-9899	Gies 11, 14, 19-32	Confirmed	N/A	N/A	N/A
631	123-9953	NC Farms 9, 10, 15, 16, 20-32	Confirmed	N/A	N/A	N/A
597	123-4541	State Lease 81 23-16	Confirmed	N/A	N/A	N/A

Attachment E
Results Summary for Tank System Data Review

Tank System AIRS ID	AIRS ID	Tank System Name
321	123-5868	Adams 31, 41-10, 41-10H
326	123-6630	Anderson 21, 22-34
330	123-9E68	Becker Ranch 5 (Pad 1) E-223,403;J-303,343
332	123-9E5A	Becker Ranch 5 (Pad 3) M-203,323,423; R-243,303,443
333	123-9E5A	Becker Ranch 5 (Pad 4) R-203,323;U-243,303,443
342	123-7924	Cannon Farms 1-35C
346	123-9E11	Churchill 28 Sec. 28E-203, 423; 28J-203, 343, 423, 443; 28M - 343, 443
347	123-5030	Cockroft 34, 43, 44-11
353	123-5220	Ewing 1; 32-31
354	123-6790	Floyd 5;Tarin Federal 32 Sec HZ (32W-234,434;32X- 204,314,334;32Y-214,314,404)
360	123-7022	Hankins 43, 44-20U
370	123-4506	Johnson 2-21
373	123-4521	Knox 41-3
375	123-5160	Lapp 33-12, Schrant 34-12
377	123-2470	Lee 1-10
378	123-9235	Leffler 33, 34-2; 2SD
392	123-4233	Opel 17-2; 3, 4, 5
394	123-4248	Peschel 20 Sec HZ; 5-20
395	123-6093	Peschel 23-20B
400	123-9CF8	Richter 34M-203, 423; 34R-343 (West)
401	123-9CF8	Richter 34R-223, 403, 423; 34U-303 (East)
407	123-3043	Shupe 13-32, 33; Moore 13-31, 35
410	123-9EEA	Spaur 10 Sec Pad 1
417	123-9E41	Stroh 13 Sec Pad 1/2
419	123-9DED	Thornton 15E-432
422	123-8292	Trinity 23-7; Johnston 14-7
429	123-7460	Wiedeman 11, 12, 21, 22-21 U
431	123-7224	Wiedeman 33, 43-21 U
434	123-1488	Witwer 34, 44-6D, 43-6; Hoff 33-6
437	123-7011	Zimmerman 11D, 12, 21D, 22-17 U, 17AD U
444	123-1657	Bihain 26-1, 4; 5
449	123-5022	Booth 14, 23, 24, 33-35
451	123-5950	Caraccioli 1
454	123-5873	Cecil 31, 41-2
456	123-9E04	Chesnut 28 (Pad 2) M-203,323,423; 28R-243,443
463	123-9C8D	Diana 6T-241, 321, 401; 6Q-421
465	123-2407	Eckhart 34-1; 34, 43, 44-34; 5
467	123-5871	Fabrizius 31, 41-1; Bay Family Trust 32-1
478	123-9DAB	Guttersen 31Q-221, 401; 31T-301, 441 (Pad 2)
479	123-9DA2	Guttersen 31T-221, 401; 31Y-301, 441 (Pad 4)
483	123-9DA7	Guttersen 6R-323; 6U-203 (Pad 3)
488	123-9D88	Hill 6L-421
493	123-9399	Knievel 13, 14, 23, 24-12D; 12BD

Tank System AIRS ID	AIRS ID	Tank System Name
498	123-2478	Loloff 35-5
499	123-9F06	Loloff Farms 26 Sec Pad 1
504	123-2578	SunMarke 28V-234, 304, 434; 28W-414;McCarty 28-2(South)
505	123-2578	SunMarke 28U-334, 434; 28V-214, 404 (North)
506	123-6115	McLeod 1, 5; 1-29B
511	123-5946	Noffsinger 31,32-2D; 2C,RD,SD,VD; Frudden 1
512	123-9CB1	O Investment Properties 6T-421; Y-241, 401
515	123-6987	P&H 22-32, 42; 22CD, 22SD
519	123-5960	Pettinger 33, 34, 43, 44-2
525	123-9B92	Simonsen 12E-223; 12J-243; 1I-421; 1L-241
527	123-9C3C	Simonsen-Schaefer 7E-203, 423; 7J-243, 403; 7M-243
531	123-9713	Stille 12-6H
532	123-9E01	Suden 34M-223, 423; 34R-203, 343 (West Pad)
537	123-4496	Webster 32, 41, 42-11
550	123-9521	Wells Ranch 43-34H
551	123-6203	Wilson 11, 12, 21, 22-30
556	123-1617	Alles 22 Sec Pad 1; 9-22
559	123-1676	Brent 1-6I; 1; Duell 20-1; Lucille 1-6I, 20-1; Pigeon 1, 5; 1-6B
561	123-9B37	Brown 2E-232; 2F-202, 412, 432; 2G-212
564	123-9AD4	Carmichael 26M-223, 26U-243
570	123-1629	Emily 1; 24-19; Mowery 19-1; 5; Ivan Klein 13-20
581	123-9F2B	Seth 1, 5
583	123-4218	Maxey-Hoff 1, 2
590	123-4230	Schneider 19 Sec HZ
592	123-9ACA	Schaefer 10E-223, 10M-243
597	123-4541	State Lease 81 23-16
599	123-9DC8	Thornton 14K-441
608	123-9326	Wilson 34-34H
610	123-8441	Apollo 41, 42-18
618	123-9899	Gies 11, 14, 19-32
624	123-9E4A	Kaiser 17, 41, 42-10
562	123-1492	Carlson 33, 34-7
631	123-9953	NC Farms 9, 10, 15, 16, 20-32

